

CHECKLISTS FOR GROUND WATER MODELING AT HTRW SITES

A. Scope Development Checklist

This enclosure provides a checklist of topics to be addressed in a scope-of-work (SOW) for various ground water modeling efforts. Refer to section 6.9 of the RI/FS scope outline for scope topic headings. Many of the items can be left to the Contractor. The Contractor should be allowed flexibility for methodology based on their experience and software and equipment; however, it is important that the work be quantifiable. Topics that should be included in each scope will be indicated by "Required"; those items that are not always necessary but should be considered in each scope will be indicated by "Recommended"; and those items that may be considered in some cases will be indicated by "Optional".

1. Are the modeling objectives stated? (Required)

Establish whether the model is to be used for prediction (for risk assessment and remedial design), hydrogeologic system interpretation (to assist in planning remedial investigations), or as a generic study of flow and transport in hypothetical hydrogeologic conditions. Be as specific as possible.

2. Are previous studies referenced and summarized? (Recommended)

Previous field and modeling studies and sources of data are helpful in preparing for new modeling efforts. Provide the full reference for any previous known modeling studies or reports prepared for the site.

3. Is the development of a site conceptual model specified? (Required)

The conceptual model scope should include requirements to define geometric structure of the site (aquifer thickness, lithology distribution, heterogeneities, etc.), physical and chemical processes involved at the site (recharge/discharge, evapotranspiration, etc.), and boundary conditions imposed on the model.

4. Is the type of model specified? (Recommended)

1-, 2-, 3-dimensional? Ground water flow only or contaminant transport model? Steady-state or transient? Consider the amount of data known to exist at the site and whether it will support the model envisioned. Also consider the objectives of the modeling effort. It may be appropriate to discuss this with the potential Contractor during negotiations. Additional support can be obtained from the HTRW-MCX, waterways Experiment Station, the Hydrologic Engineering Center, and the Army Environmental Center.

5. Is the area to be studied defined? (Required)

The scope needs to describe the area of interest for the problem. It may be the site, the immediate vicinity of the site or regional in nature. This depends on the objectives of the model, the outside influences on ground water and contaminant flow, and the spatial distribution of data.

6. Is model verification specified? (Required)

The model should be or have been tested with a sample set of data and compared to (verified with) analytical solutions. In most cases, the Contractor should use a well accepted and documented code, such as those developed by the U.S. Geological Survey and Environmental Protection Agency.

7. Is calibration required by the scope? (Required)

The model must be calibrated to existing site conditions. If

the site is currently being stressed (e.g. by an extraction system), calibration should be to prestressed conditions if data are available.

8. Is a sensitivity analysis specified? (Required)

The scope should require the Contractor to determine the effect varying model parameters has on model results.

9. Are scenarios to be evaluated described? (Recommended)

If the designer has specific modeling scenarios in mind they should be described in this section. If specific scenarios are not included, the objectives of the modeling effort MUST be explicit to allow the Contractor to determine appropriate simulation scenarios.

10. Is a modeling workplan specified? (Required)

This would be part of the overall project workplan. Is the format specified? See companion checklist for suggested topics/format.

11. Modeling report required? (Required)

This report would be most appropriate as a technical appendix to the overall project report (RI report, PA/SI report, etc.) rather than a separate submittal. A format should be specified. The scope should discuss the types of graphics, etc. that will be required. A suggested report format is discussed in Chapter 9 of Applied Groundwater Modeling: Simulation of Flow and Advective Transport, by Anderson and Woessner, Academic Press, 1992.

B. Workplan Review Checklist

These topics are meant to be used as a checklist of items the Contractor should cover in the workplan. See explanation of topics under Scope Development Checklist. The modeling workplan could be prepared as a separate part of the overall project workplan.

1. Are modeling objectives clear and adequate background information provided?

Workplan should define purpose of modeling effort in specific terms, present an evaluation of previous studies, and describe the relevant site conditions. Some or much of the site background information may be included elsewhere in the overall project workplan.

2. Is the site conceptual model and analysis approach described?

In addition to items listed in the Scope guidance (part A-3 of this checklist), the following should also be addressed. Are saturated or unsaturated conditions being analyzed? Is single-phase or multi-phase flow being modeled? How many contaminants are being modeled? Are steady-state or transient conditions being modeled?

3. Is the modeling computer code selected by the Contractor described and justified? Are the assumptions inherent in its use clearly described?

Is the code selected consistent with the conceptual model developed for the site, with the data available for input, and with the objectives of the study? The plan should directly discuss this in detail.

4. Is a code validation history provided?

This is most applicable for proprietary codes or for codes not previously encountered by the USACE technical staff. Has the code been verified against analytical solutions? Is a benchmark or other test provided to verify proper installation and operation on the user's computer system? Even if a widely accepted model is proposed, if the code has been modified to any extent, for example for graphical output or simulation of site-specific processes, it must be fully validated and documented.

5. Is the model geometry described?

This would include the area to be modeled (including sufficient excess area on all sides of the site to avoid boundary effects of the model), node or grid spacing, and grid orientation (for finite difference models). This would include vertical as well as horizontal aspects for 3-D applications.

6. Are model input parameters described?

The necessary input should be described along with an overview of the sources of data for these parameters. Uncertainty involved with assignment of parameter values should also be discussed. For contaminant transport simulations, source, history, concentration, and areal extent data should be presented. The plan should identify what, if any, steps are being taken as part of the overall scope-of-work to gather additional data to support the modeling.

7. Are boundary conditions defined and justified?

8. Is the calibration procedure described?

At a minimum this should include comparison with field data, including water levels and contaminant concentrations (for transport modeling). This should also discuss the procedure to be used for sensitivity analysis.

9. Is a procedure described for dealing with uncertainty in input data?

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Procedures include use of a "safety factor" or conservative approach to scenarios, parameter estimation routines, probabilistic analysis of parameter variation, etc. Note that larger uncertainties may be acceptable for parameters to which the model is less sensitive.

10. Are the proposed scenarios described in detail?

The level of detail need not be extreme because this often changes based on preliminary results and calibration. Are the simulation times proposed for the scenarios meaningful for the study being performed?

11. Is the modeling report described?

This should include an outline of the report at a minimum. The report submission should include the data files. Depending on the code (proprietary or public domain, negotiated costs for purchasing the model for this project, etc.), it may be appropriate for the Corps to be provided the code as well.
